REMARKS

Claims 3-34 are pending in this application. As a result of claim amendments in this Response to Office Action, claims 3-34 will remain pending.

In the Office Action, the Examiner accepted Applicants election in the July 17, 2006 response to Office Action of Group II, consisting of claims 3-32, drawn to a method to prepare a high 1,4-cis polybutadiene copolymer, for prosecution in this application. In that Response, Applicants canceled claims 1 and 2 and added new claims 33 and 34.

The Examiner has now rejected claims 3-32 under 35 U.S.C. §103(a) as being unpatentable over Baack et al. (U.S. Patent No. 4,242,468 or GB 2 028 356 A) in view of Pedretti et al. (GB 2 002 003 A) and Jenkins et al. (U.S. Patent No. 5,017,539). According to the Examiner, the difference between the present claims and the disclosure of Baack et al. is the requirement of a step to prepare the monohydroxy-terminated polybutadiene having high content of cis-units, and it would have been obvious to adapt the method disclosed by Jenkins et al. in the disclosure of Baack et al. and thereby obtain the present invention.

The Examiner also rejected claims 33-34 under 35 U.S.C. §103(a) as being unpatentable over Baack et al. in view of a Pedretti et al. According to the Examiner, the difference between claims 33-34 and the disclosure of Baack et al. is the requirement of the monohydroxy-terminated polybutadine to be used in forming the polyurethane having high content of cis-units, and it would have been obvious to use monohydroxy-terminated polybutadiene having high content of cis-units and thereby obtain the present invention.

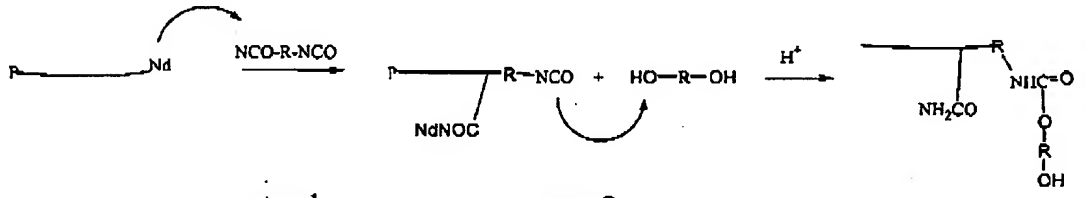
Baack et al. describe a method of preparing polyurethanes by reacting at least one polyisocyanate with at least one polyol under polyurethane-forming conditions, which may include the presence of a catalyst, and in the presence of a monohydroxy-terminated polybutadiene of molecular weight of 500 to 100,000 as an internal plasticizer for the polyurethane, wherein the use of a polybutadiene diol as the polyol is excluded.

Pedretti et al. disclose a catalyst system comprising a particular organo-aluminium compound, or aluminium hydride, a Lewis acid containing at least one halogen, and a compound ML3 where M is a lanthanide an L is a particular organic ligand. The use of the catalyst system gives polymers having high contents of 1,4-cis units.

Jenkins et al. describe a process for preparing a catalyst for the polymerization of butadiene to obtain a polymer containing a very high content of cis isomer. The high 1,4-cis polybutadiene is prepared by a process for the polymerization of butadiene comprising contacting in hydrocarbon solvent an alkyl aluminum or alkyl aluminum hydride, neodymium carboxylate and a source of halogen.

The object of this application is to provide a novel elastomer based on high cis stereoregularity polybutadiene, which is end-modified with polyurethane to increase abrasion and wet-skid resistance. In order to prepare the high cis polybutadiene modified with polyurethane, two reaction steps are conducted: (1) pseudoliving functionality of neodymium catalyst is employed in reaction with an isocyanate compound, and (2) condensation for further urethane bond formation is carried out with an isocyanate having at least two functional groups and an alcohol having at least two functional groups to yield a multi-branched high 1,4-cis polybutadiene-polyurethane copolymer (see Figure 1 below, which shows the two reaction steps of Nd-catalyst having pseudoliving character with isocyanates and isocyantes with alcohol).

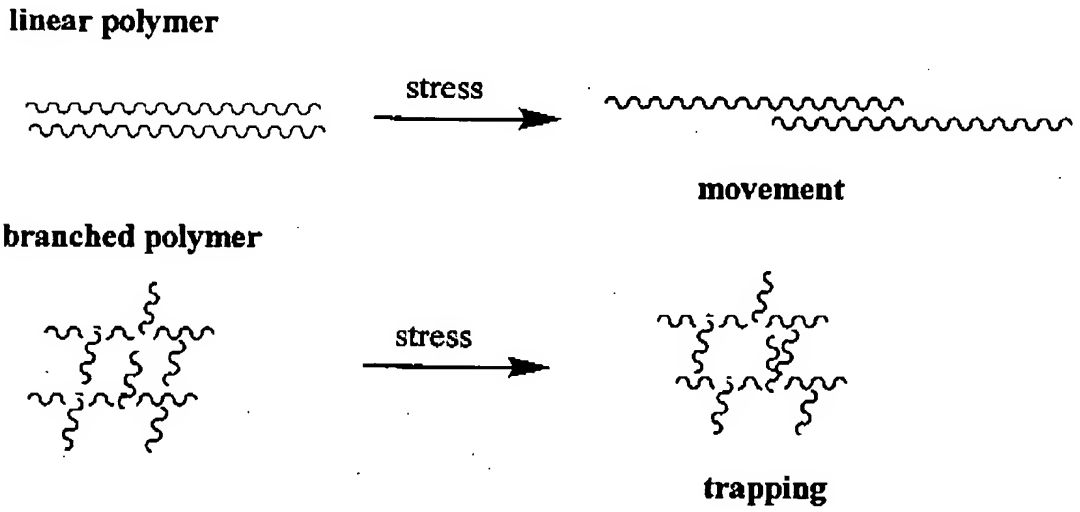
Figure 1:



step 1 step 2

Cold-Flow Control is a long strived-for goal in the rubber industry. Generally, neodymium-polybutadiene possesses high cold flow due to its linear molecular structure (see Figure 2 below, which is a representation of cold-flow phenomena).

Figure 2:



The present invention first reduces cold flow by modified polyurethane units. High 1,4-cis polybutadiene-polyurethane copolymer also exhibits low cold flow and high affinity to silica or carbon black as well as excellent in elasticity and abrasion resistance.

As seen in the step 1 reaction (see Figure 1), the present invention utilizes living character of neodymium active-end, but does not use hydroxy polybutadiene to react with isocyanates. By contrast, however, Baack et al. teach that hydroxyl polybutadiene is employed. In contrast to Baack et al., Applicant's invention does not require monohydroxy terminated polybutadiene because of pseudoliving functionality of neodyumium catalyst instead of monohydroxy terminated polybutadiene.

Furthermore, Jenkins et al. and Pedretti et al. describe processes and catalysts for preparing high cis polybutadiene but do not mention the living character of neodymium or how to make functional polybutadiene. By contrast, in the present application, the main purpose in

making polybutadiene-polyurethane copolymer is to modify polybutadiene rubber for enhancing its physical properties such as abrasion resistance and tensile strength, and for lowering the cold-flow. The claimed method is for preparation of a high 1,4-cis polybutadiene-polyurethane copolymer to be used in tires or golf balls, and not for plasticizer in polyurethane.

Accordingly, claim 3 has been amended to recite in step (a) that the step of polymerizing 1,3-butadiene or butadiene derivatives with a catalyst comprising a rare earth compound, a halogen-containing compound and an organoaluminum compound in the presence of a non-polar solvent is to prepare polybutadiene having a high 1,4-cis content of at least 95 % and to exclude monohydroxy-terminated polybutadiene, thereby distinguishing over the prior art. These amended are supported in the specification at page 4, lines 1-4; page 5, lines 1-6; page 8, lines 3-5, and page 14, lines 4-7, and at page 4, lines 17-27. Thus, the rejections of claims 3-34 should be withdrawn and that those claims as amended should be allowed.

Conclusion

Reconsideration of the present application, as amended, is requested. If, upon review, the Examiner has any questions with regard to this Response or is for any reason unable to enter the amendments as presented, the Examiner is respectfully requested to telephone Applicant's undersigned attorney in order to resolve any outstanding issues and advance the prosecution of the case. An early and favorable action on the merits is earnestly solicited.

Respectfully Submitted,
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